Lao
Institute for
Renewable
Energy

Water
Purification
Technologies

# Field test of the WATER PPS

## Report

# DWS-2-1

**David APPEL**

Vientiane

May 2008

Lao Institute for Renewable Energy

# LIRE

## REPORT # DWS-2-1

# Field test of the WATER PPS

**David APPEL**

Vientiane

May 2008

## About us

LIRE is a non-profit organisation dedicated to the sustainable development of a self sufficient renewable energy sector in the Lao PDR. The institute offers agronomical, technological and socio-economic research services, and works to provide a free public resource of information and advice on the use of renewable energy technologies in Laos. LIRE strives to support the development of the country by exploring commercially viable means to establish renewable energy technologies in rural parts of the country, in areas without connection to the national grid and with little access to technical expertise.



ສູນຄົ້ນຄ້ວາ - ທົດລອງດ້ານພະລັງງານທົດແທນ

*Thai-Lao Road, km3,*
*Wattnak village, Vientiane, Lao PDR*
*P.O. Box 9077*

*Tel: +856 21 353 430. Fax: +856 21 314 045.*
*Email address: contact@lao-ire.org.*
*Web-site: www.lao-ire.org*

# Contents

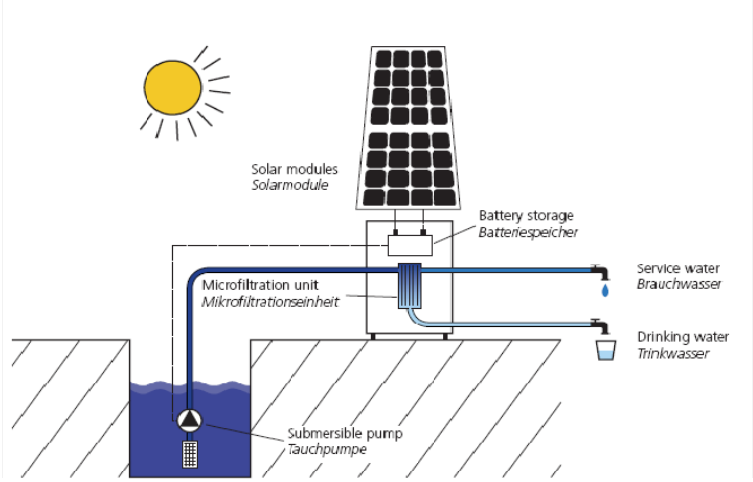
**Figure 1** The Water PPS

## 1. Introduction

The WATER PPS (**p**umping and **p**urifying **s**ystem) is a solar powered device which is used to set up a water supply in areas which are not connected to the electricity grid. It is constructed as one compact unit, including the filtration system, the control electronics and the power supply. It is very simple to use and its design makes it easy to transport.

## 2. Mode of Operation

**Figure 2** Scheme of the operational concept of the WATER PPS.




The device has a simple but effective mode of operation:

A submersible pump extracts water from any raw water source. The water can either directly be used as service water, for example for irrigation purposes, or it can be pumped through a micro filtration unit in order to obtain clean drinking water. A 55 W solar panel supplies the device with energy. The energy is stored in two 42 Ah batteries in order to allow the system to operate without permanent solar radiation.

## 3. Design of the Field Test

The system was tested in three villages in Vientiane province in the Lao P.D.R.: Ban Koy, Ban Naphor and Ban Xo. Different raw water sources were used in the three villages (see Table 1). The systems were intensively monitored over a 140 day period between March and July 2007. The monitoring included measurements of the system performance (drinking water output and total amount of purified water), maintenance effort, energy balance and water quality. Furthermore, the study was also designed to ascertain whether people in the remote villages are able to run the system autonomously. The systems were installed by trained technicians and the monitoring was

mainly done by a trained ***Sunlabob*** franchisee[1]. The water quality tests were undertaken by the Ministry of Health of the Lao P.D.R.

**Table 1** Water sources in the different villages.

| Location | Water source |
|---|---|
| Ban Koy | Well (dug) |
| Ban Naphor | Well (drilled) |
| Ban Xo | River |

## 4. Results

The simple mode of operation allowed the people in the villages to run the systems without any problems. All systems worked reliably, successfully providing purified water free from bacteria. However, the well water was found to be too acidic to meet Lao standards[2], hence only the purified river water received the drinking water certificate.

**Figure 3** Clogged filter

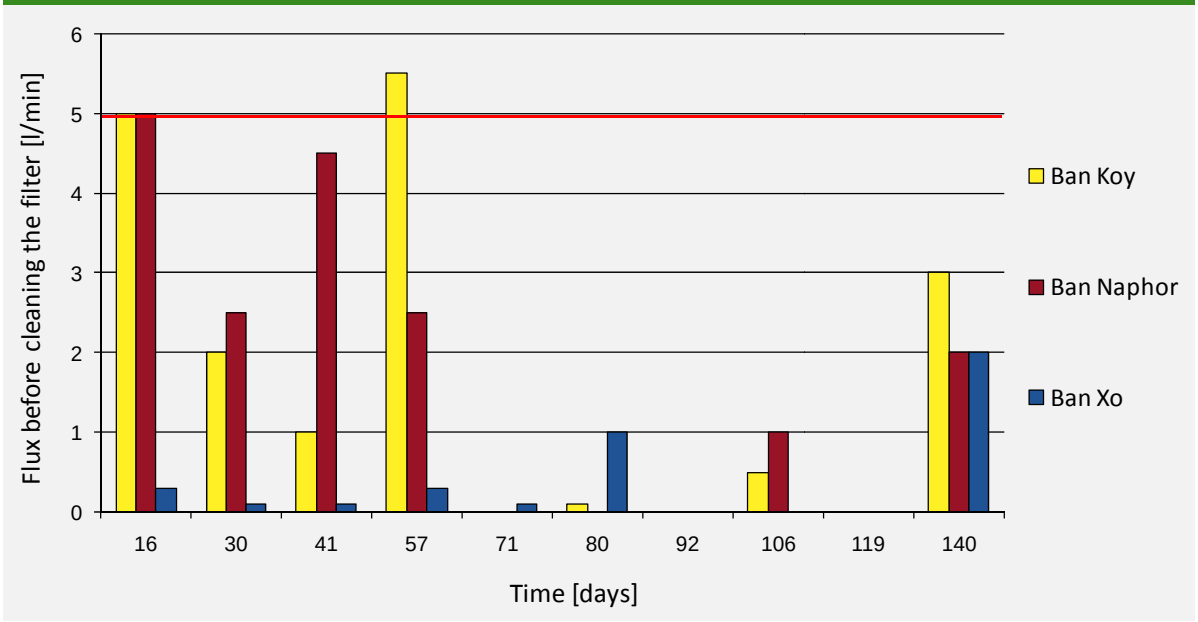
Since all water sources were turbid, the filter of the units clogged quickly. Over several periods of time no water was pumped due to a clogged filter. In these particular conditions, cleaning the filter is necessary approximately every 1000 litres. Prior to the study, it was assumed that filters would not get clogged that fast, which means cleaning intervals were set too large. Since the quality of the water greatly changes with variations in rainfall, in addition to other factors, the time taken for a filter to clog depends on ambient weather conditions.

Figure 1 below shows the measured drinking water output of the system immediately before the filter was cleaned. The lower the output the more the filter was clogged. As can be seen, the filter clogged rapidly between day 57 and day 119 although there was little water being purified in that period. This shows that the efficiency of the system is greatly influenced by weather conditions (the two villages are close to each other).

[1] The field test was done in cooperation with *Sunlabob Renewable Energy* (www.sunlabob.com).

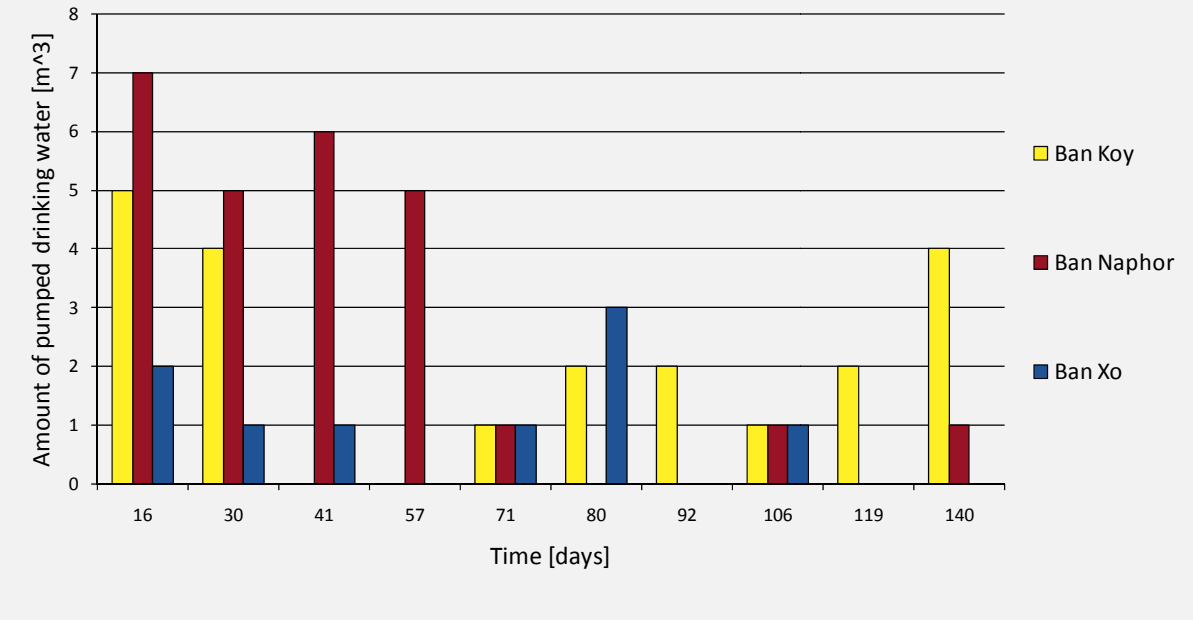
[2] The health ministry prescribes a pH value between 6.5 and 8.5.

**Figure 4** Drinking water output measured immediately before the filter was cleaned. The filter was cleaned after each measurement of the flow rate (and thus after each data point). The red line indicates the output of the system with clean filters guaranteed by the manufacturer.



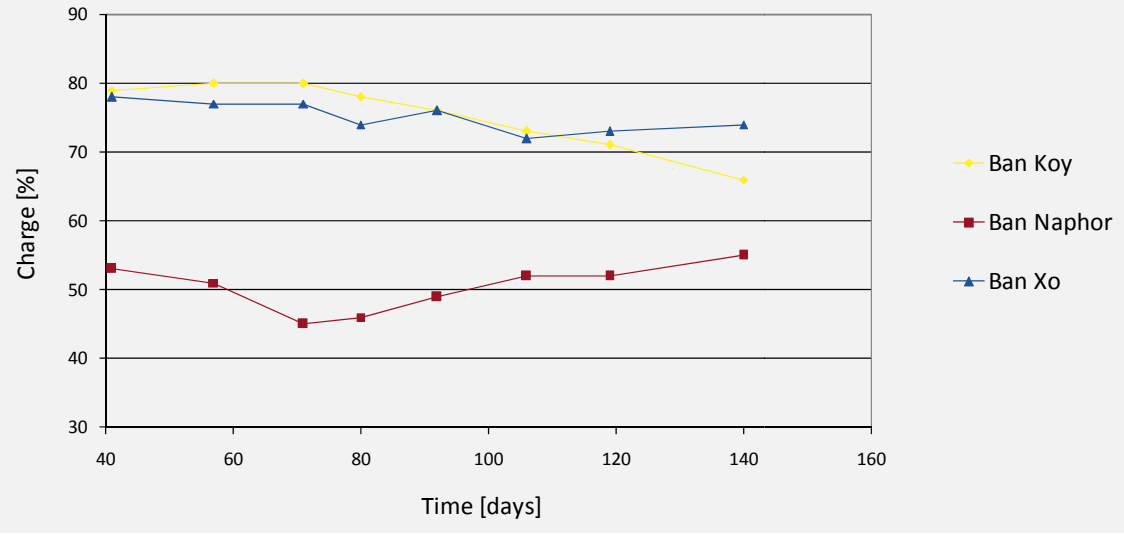

Rainfall increases the turbidity of the water source and thus accelerates the clogging of the filter. Unfortunately accurate local weather records are not available for this study; hence it was not possible to observe any direct correlation between the amount of filtered water since the last filter maintenance and the condition of the filter.

**Figure 5** Pumped drinking water following filter maintenance.



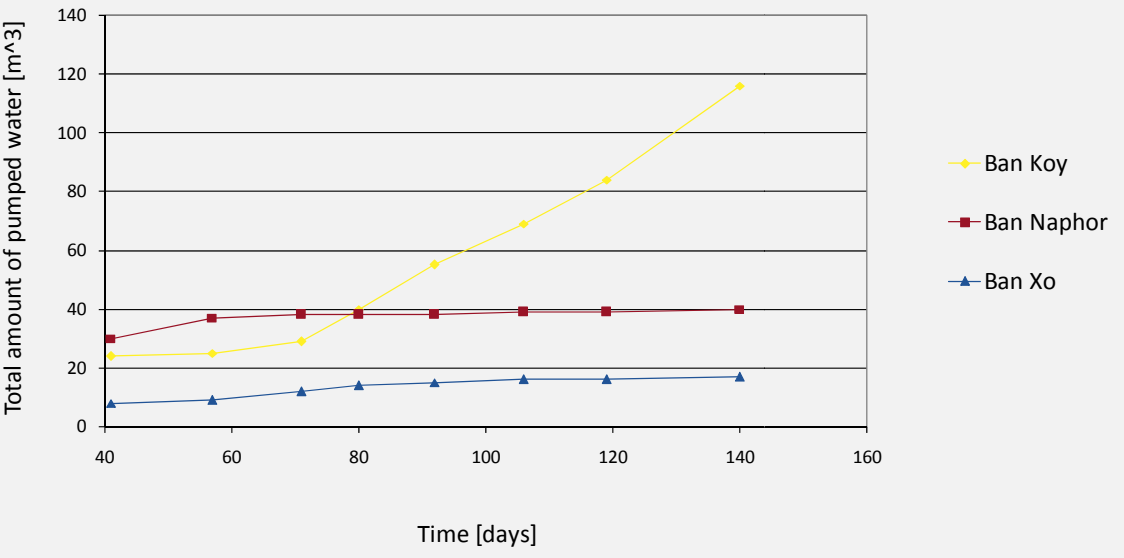
However, the effect of larger seasonal variations is visible, such as the decrease in flux following day 57, when the rainfall increased as a precursor of the rainy season. The data from Ban Xo is stable since the river water source is constantly turbid irrespective of rainfall.

**Figure 6** Average battery charge status in the morning




The battery condition shown in figure 6 confirms that the solar panels provided adequate power supply to the system. However, when the system was used for longer periods of time without interruption, it occasionally switched off to protect the battery from deep discharge. This occurred between measurements, thus cannot be seen in the plot.

**Figure 7** Total amount of pumped water in the three test sites. Note that this graph only shows the amount of water which has actually been pumped and not the maximal possible amount.



## 5. Conclusions

All the systems worked under real conditions, including high temperatures and high humidity, without any problems. All systems provided germ free water during the whole period of monitoring.

Maintenance effort tends to be high if the water source is significantly turbid. This is because the filters clogged very quickly. This strongly reduces the output, although the quality of the drinking water is unaltered. It can hence be assumed that maintenance efforts can be significantly reduced by installing a pre filter (e.g. a simple sand filter or a steel filter with a back flush mode) in front of the water inlet of the system.

The energy supply was mostly sufficient. Temporary shortages only took place when the system was intensively used over a longer period of time.